

REMARKS

Claims 1-10 are pending and presented for examination in the subject application, with claim 1 in independent form. Applicants have hereinabove amended claim 1 to place the claims in better form for examination and clarify the claimed invention.

Applicants maintain that no new matter is introduced by this Amendment. Accordingly, Applicants respectfully request that this Amendment be entered.

Objection to the Disclosure

In Section 2 of the June 17, 2004 Office Action, the disclosure was objected to as purportedly having informalities.

In response, Applicants have amended the specification hereinabove to correct the informalities.

Accordingly, withdrawal of the objection to the disclosure is requested.

Rejection Under 35 U.S.C. §102(b)

In Section 4 of the June 17, 2004 Office Action, claims 1-6 and 8-10 were rejected under 35 U.S.C. §102(b) as purportedly anticipated by Japanese Patent Application No. 10-141516 to Akiyuki et al.

The Office Action states that Akiyuki discloses a gaseous fuel supply apparatus with a shut-off valve, which supplies gaseous fuel from a gaseous fuel tank storing gaseous fuel to a gaseous fuel combustion engine using gaseous fuel, comprising a gaseous fuel flow unit which is communicated with the gaseous fuel tank and the gaseous fuel combustion engine and flows gaseous fuel

between the gaseous fuel tank and the gaseous fuel combustion engine; a shut-off valve which is provided in the gaseous fuel flow unit and selectively opens or closes a flow of the gaseous fuel in the gaseous fuel flow unit; and a gaseous fuel charge unit which is provided in the gaseous fuel flow unit between the gaseous fuel combustion engine and the shut-off valve and is used to charge the gaseous fuel from an outside into the gaseous fuel flow unit, the shut-off valve comprising: a valve housing which includes a first connection port connected to a first part of the gaseous fuel flow unit, the first part being close to the gaseous fuel tank, a second connection port connected to a second part of the gaseous fuel flow unit, the second part being close to the gaseous fuel engine and the gaseous fuel charge unit, and a valve chest provided between the first connection port and the second connection port and having a valve port communicating the first and second connection ports with each other; a seal member which surrounds the valve port on an inner surface of the valve chest of the valve housing; valve member which is provided in the valve housing and is movable between a closed position and open position, at the closed position the valve member being in contact with the seal member and closing the valve port of the valve chest and at the open position the valve member separating from the seal member and opening the valve port of the valve chest; and a valve member drive unit which drives the valve member by an electromagnetic force.

Regarding claim 5, the Office Action states that Akiyuki discloses that a filter (28) is provided in at least one of the first connection port and second connection port.

Regarding claims 6 and 7, the Office Action states that Akiyuki discloses a plunger (14) and solenoid coil (12).

Applicants maintain that Akiyuki does not render the claimed invention unpatentable, because Akiyuki fails to disclose or suggest each and every element of the claimed invention.

The present application relates to a gaseous fuel supply apparatus with a shut-off valve which supplies gaseous fuel from a gaseous fuel tank storing gaseous fuel to a combustion engine. In particular, the claimed invention provides a gaseous fuel supply apparatus having a structure which has a low likelihood of failure which typically is caused in a conventional apparatus with shut-off valve (such as in Akiyuki) by high-pressurized gas.

Akiyuki, as understood by Applicants, is directed to preventing slip-off of a rubber valve (caused by high pressure fluid), by boring a through hole with an opening in a valve mounting face of a plunger in a high pressure solenoid valve used to control the flow of a high pressure fluid.

In Akiyuki (see Figs. 1, 3 and 4), annular seal member 38 or 74 of the shut-off valve is attached on an annular attachment groove formed on an outer surface of valve member 31 or 72. The seal member 38 or 74 along with the valve member 31 or 72 is movable between a closed position and an open position. At the closed position the seal member 38 or 74 on the valve member 31 or 72 is brought into contact with the valve seat 25 or 66 of the valve port 24 or 65 of the valve housing 21 or 62 to close the valve port 24 or 65, and at the open position the seal member 38 or 74 on the valve member 31 or 72 is separated from the valve seat 25 or 66 to open the valve port 24 or 65.

Reference numerals 22 and 63 in Akiyuki indicate input ports, and

reference numerals 23 and 64 indicate output ports.

In the structure disclosed in Akiyuki the seal member 38 or 74 are easily damaged. And, the damage of the seal member 38 or 74 allows the shut-off valve of Akiyuki to be easily damaged. It is submitted that damage of the seal member 38 or 74 in the shut-off valve disclosed in Akiyuki will likely occur for the following reasons.

At a first stage, when the high pressurized gas which is passed through the valve hole 38 or 74 and expanded in the adiabatic condition in the valve chest 26 or 67 is directly blown with high speed onto the seal member 38 or 74 on the valve member 31 or 72, the seal member 38 or 74 vibrates and repeats expansion and contraction by the high pressurized gas blown thereon and accumulates a fatigue of its material before the seal member 38 or 74 on the valve member 31 or 72 is lowered in its temperature and its elasticity by the high pressurized gas which is expanded in the adiabatic condition and is lowered in its temperature. This accumulation of fatigue of the material progresses as the high pressurized gas charging operation is repeated, and renders the vibrated seal member 38 or 74 easily damaged owing to rubbing of the vibrated seal member 38 or 74 with the inner peripheral surface of the annular attachment groove formed on the outer peripheral surface of the valve member 31 or 72.

At a second stage in which a certain time has passed from start of the high pressurized gas charge operation of Akiyuki, the seal member 38 or 74 onto which the high pressurized gas, which expanded in the adiabatic condition and lowered its temperature, is blown is easily removed from a predetermined position in the annular attachment groove formed in the outer peripheral surface

of the valve member 31 or 72 owing to some reasons such as the damage of a part of the seal member 38 or 74 caused at the first stage or deterioration with age of the seal member 38 or 74. In addition, the removed seal member 38 or 74 is rubbed with a region other than the predetermined position in the inner peripheral surface of the annular attachment groove or with the outer peripheral surface of the valve member 31 or 72 in a condition that the seal member 38 or 74 is lowered in its temperature and its elasticity by the high pressurized gas expanded in the adiabatic condition, lowered in its temperature, and blown onto the seal member 38 or 74. The seal member 38 or 74 removed, and rubbed as described above at the second stage is more easily damaged because the seal member 38 or 74 have been damaged with the accumulation of the fatigue of the material and the rubbing with the inner surface of the annular attachment groove at the first stage.

Even if a portion or the whole of the seal member 38 or 74 of Akiyuki which has displaced from the predetermined position in the annular attachment groove is not damaged while the high-pressure gas is supplied as mentioned above, a portion or the whole of the seal member 38 or 74 is easily be damaged, as the seal member 38 or 74 becomes sandwiched between the outer surface of the valve member 31 or 72 and the inner surface of the valve port 24 or 65 when the supply of the high-pressure gas is stopped and the valve member 31 or 72 returns to the closed position.

Sealing members which have been damaged as described above cannot make the shut-off valve function properly. A portion or the whole of the seal member 38 or 74 of Akiyuki which has been damaged and has fallen off causes various failures in the gaseous

fuel flow unit to which the shut-off valve is attached. In a prior gaseous fuel flow unit which uses a shut-off valve with a structure as disclosed in Akiyuki, a by-pass detouring the shut-off valve is provided in the gaseous fuel flow unit extending between a connection port for an outer high-pressurized gas supplying source and a port of a high-pressurized gas tank, to prevent the above failure of the shut-off valve when high-pressurized gas is supplied from the outer high-pressurized gas supplying source to the high-pressurized gas tank through the shut-off valve. Thus, in the prior gaseous fuel flow unit the high-pressurized gas can be fed from the outer high-pressurized gas supplying source to the high-pressurized gas tank through the by-pass without passing through the shut-off valve.

In the prior gaseous fuel flow unit, a check valve is provided at the connection portion between the gaseous fuel flow unit and the by-pass so that the high-pressurized gas always goes through the shut-off valve and not the by-pass when the high-pressurized gas is supplied from the high-pressurized gas tank to a gaseous fuel consuming unit, such as an internal consuming engine using gaseous fuel, for example. If the shut-off valve of Akiyuki is used to supply the high-pressurized gas from the outer high-pressurized gas supplying source to the high-pressurized gas tank as described above, it is likely that the shut-off valve and the gaseous fuel flow unit will fail. A by-pass with a check valve, as mentioned above, is necessary to avoid such a failure. However, the structure of the gaseous fuel supply apparatus which has the by-pass with the check valve is complex, and the cost for manufacturing such an apparatus becomes high.

The shut-off valve used in the gaseous fuel supply apparatus described in claim 1 of the present application is structurally

different from the shut-off valve of Akiyuki and overcomes the disadvantage described above.

In the gaseous fuel supply apparatus of claim 1 of the present application, the seal member of the shut-off valve surrounds the valve port on the inner surface of the valve chest of the valve housing. The valve member provided in the valve housing is movable between the closed position and the open position, wherein at the closed position the valve member is in contact with the seal member and closes the valve port, and at the open position the valve member separates from the seal member and opens the valve port. In the shut-off valve of claim 1 of the present application having such a structure, when the gaseous fuel is supplied from the outer gaseous fuel supply source to the gaseous fuel tank connected to the first connection port of the valve housing through the second part of the gaseous fuel flow unit connected to the second connection port of the valve housing, while the valve member of the shut-off valve is disposed at the open position, the gaseous fuel which flows from the second connection port to the first connection port through the valve port is expanded in the adiabatic condition and blown with high speed onto the valve member.

However, the seal member of claim 1 is not provided on the valve member, and surrounds the valve port on the inner surface of the valve chest of the valve housing. Therefore, the gaseous fuel of which the temperature has rapidly been lowered by its expanding in the adiabatic condition is not directly blown with high speed onto such a seal member. As a result, although the elasticity of the seal member is lowered, the seal member does not vibrate and rotate due to the gaseous fuel which flows with high speed into the valve chest through the valve port and of which the

temperature has rapidly been lowered. Thus, material fatigue of the seal member does not accumulate and the portion or the whole of the seal member does not fall off from the inner surface of the valve chest. This means that the shut-off valve used in the gaseous fuel supply apparatus of claim 1 of the present application is less likely to fail as compared to the shut-off valve disclosed in Akiyuki.

In such a way, even if the gaseous fuel supply apparatus of claim 1 of the present application is used to supply the gaseous fuel from the outer gaseous fuel supply source to the gaseous fuel tank, it is unlikely that the gaseous fuel supply apparatus and the gaseous fuel flow unit will fail. Therefore, while the shut-off valve and the gaseous fuel supply apparatus using the shut-off valve of Akiyuki needs a by-pass with a check valve to avoid the above described failure, a by-pass with a check valve is unnecessary in the gaseous fuel supply apparatus of claim 1. The gaseous fuel supply apparatus of claim 1 is simple in structure and can be manufactured at a lower cost, as compared to the shut-off valve of Akiyuki and the gaseous fuel supply apparatus using the shut-off valve which needs a by-pass with a check valve.

Therefore, claim 1 of the present application is patentable over Akiyuki.

Regarding claims 2-6 and 8-10, Applicants respectfully point out that claims 2-6 and 8-10 depend on and include all the limitations of claim 1. Thus, claims 2-6 and 8-10 are patentable at least for the reasons set forth above with respect to claim 1.

Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw the rejection under 35 U.S.C. §102(b).

Rejection Under 35 U.S.C. §103(a)

In Section 6 of the June 17, 2004 Office Action, claim 7 were rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Akiyuki in view of U.S. Patent No. 6,120,005 to Wright (hereinafter "Wright").

The Office Action states that Akiyuki discloses the claimed invention (using one solenoid coil) as stated above except the use of two solenoid coils. The Examiner also stated that Wright teaches the use of two solenoid coils. The Examiner further stated that it would have been obvious to one of ordinary skill in the art at the time of the invention to use add an additional coil to the invention of Akiyuki as taught by Wright to improve the efficiency of the system.

Applicants maintain that Akiyuki and Wright do not render obvious the claimed invention. The claimed invention is patentable over Akiyuki and Wright for at least the following reasons.

As discussed at length above, the invention described in claim 1 of the present application is clearly different from Akiyuki in structure, operation and technical advantage.

Wright, as understood by Applicants, is directed to a dual coil fuel injector having a smart electronic switch, in an internal combustion engine. Wright was cited in the Office Action merely for its disclosure of use of two solenoid coils. Therefore, Wright does not cure the deficiencies of Akiyuki, and even a combination of the teachings of Akiyuki and Wright in the manner suggested by the Examiner fails to teach or render obvious all features of the claimed invention.

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Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw the rejection under 35 U.S.C. §103(a).

In view of the remarks hereinabove, Applicants maintain that the application is now in condition for allowance.

If a telephone interview would be of assistance in advancing prosecution of the subject application, Applicants' undersigned attorneys invite the Examiner to telephone them at the telephone number provided below.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition, and the Commissioner is authorized to charge the requisite fees to our Deposit Account No. 03-3125.

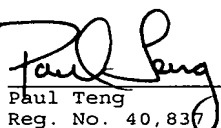
No fee is deemed necessary in connection with the filing of this Amendment. However, if any additional fee is required, authorization is hereby given to charge the amount of any such fee to Deposit Account No. 03-3125.

Respectfully submitted,



John P. White, Reg. No. 28,678
Paul Teng, Reg. No. 40,837
Attorneys for Applicants
Cooper & Dunham, LLP
1185 Avenue of the Americas
New York, New York 10036
(212) 278-0400

I hereby certify that this correspondence is being deposited this date with the U.S. Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

 September 17, 2004
Paul Teng Date
Reg. No. 40,837